Aronne Merrelli

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Education

2008 – 2012	**University of Wisconsin–Madison** Ph.D., Dept. of Atmospheric and Oceanic Sciences *Thesis title:* The Atmospheric Information Content of Earth's Far Infrared Spectrum *Advisor:* David D. Turner
2006 – 2008	**University of Dayton** M.S., Electro Optics
1999 – 2000	**California Institute of Technology** Graduate Coursework in Astrophysics
1995 – 1998	**Carnegie Mellon University** B.S., Physics, Minor in Mathematics

Professional and Research Experience

2014 – present	Space Science and Engineering Center, Madison, WI. *Associate Researcher* Staff researcher at SSEC, supervised by David C. Tobin.

- Member of NASA Orbiting Carbon Observatory-2 (OCO-2) Science team, with PI Ralf Bennartz and Co-I Chris O'Dell (Colorado State Univ.). Coordinator for "Clouds and Aerosol" theme group. Continuing postdoctoral research on 3D scattering effects for the OCO-2 carbon dioxide retrieval algorithm; Developed polarized 3D radiative transfer simulations with SHDOM; Analysis of OCO-2 L2 retrieval errors through comparison with retrieved cloud and aerosol layers from CALIOP.

- Research supporting NASA WFIRST Preparatory Science (WPS) effort with PI Margaret Turnbull (SETI Institute) and PI Tristan L'Ecuyer. Simulation of the visible and near infrared spectra of Earth-like exoplanets, to support WFIRST coronagraph capabilities. Analysis of SCIAMACHY data to derive visible to near infrared surface reflectance spectra of various Earth surfaces.

- Software development for VIIRS Fast Radiative Transfer Model (VFRTM) with PI Bryan Baum, and Yifeng Deng (Texas A&M Univ.) to support analysis activities for SNPP cloud retrieval science.

- Part of Calibration/Validation team for the Cross Track Infrared Sounder (CrIS) Science Data Record (SDR), led by PI David Tobin. Helped develop "obs - calc" framework, to compare measured spectra versus forward model calculations from NWP analysis. Performed obs - calc studies to support development and validation of candidate calibration algorithms.

- Research involving passive microwave retrievals of hydrometeors in arctic conditions, using data from the ICECAPS project with PI Ralf Bennartz and Claire Pettersen.

- Supported data processing for Micro Rain Radar (MRR) datasets with PI Mark Kulie and Claire Pettersen. Contributed to the IMProToo project from M. Maahn. Developed statistical algorithm to reduce noise observed in the MRR deployed at the NWS Marquette field office.

2013 – 2014	Space Science and Engineering Center, Madison, WI.

Research Associate

Postdoctoral research appointment with Professor Ralf Bennartz. Primary research is funded through the NASA Orbiting Carbon Observatory-2 (OCO-2) mission. Additional research on several projects related to hyperspectral infrared measurements.

- Implemented framework combining SHDOM 3D radiative transfer code with state of the art Oxygen A-band and shortwave infrared Carbon Dioxide spectroscopic databases from the OCO-2 science team.

- Work with Colorado State collaborators (C. O'Dell, T. Taylor, I. Polonsky) to run OCO-2 simulator and OCO-2 Level 2 retrieval codes.

- Work with Freie Universität Berlin colleagues on Oxygen A-band radiative transfer simulations.

- On-site support for the Scanning High-resolution Interferometer Sounder (S-HIS) deployment for the NASA Hurricane and Severe Storm Sentinel (HS3) program

- Improvements to the LBLDIS radiative transfer code to enable calculation of spectrally resolved heating rates throughout the thermal infrared

2008 – 2012	Cooperative Institute for Meteorological Satellite Studies, Space Science and Engineering Center, Madison, WI.

Graduate Research Assistant

Research on retrievals of geophysical variables using Far Infrared (FIR) radiance spectra, and effects of FIR radiative transfer in global atmosphere models.

- Implementation of Optimal Estimation algorithms, including nonlinear retrieval methods and optimal channel selection.
- Simulation of hyperspectral infrared spectra (FIR and MIR) using line-by-line radiative transfer models
- Information content analyses of simulated hyperspectral FIR radiance measurements for retrievals of thermodynamic profiles and ice cloud properties; comparison to hyperspectral MIR radiance measurements.
- Analysis of General Circulation Model data (NCAR CESM) with modified FIR radiative transfer modules.

2003 – 2008   Ball Aerospace & Technologies Corp., Fairborn, OH.
Engineer/Scientist, Advanced Multi-Spectral Sensors Group
Responsible for various tasks related to processing and exploitation of data collected from R&D sensors operated by government customers. Specific research included:

- Improved background and noise suppression algorithms
- Developed uncertainty estimation methods for signal extractions
- Developed and applied calibration, characterization, and artifact removal methods for array sensors
- Developed various data simulations for array sensors for software testing
- Analyzed specific high value or specialized data collections
- Evaluation of signal processing and tracking algorithms as applied to specific sensor data streams
- Documentation of algorithms and analyses through technical reports and briefings
- Integration of new algorithms and improvements into prototype software tools
- Requirements development and systems engineering support for processing and exploitation software development teams

2001 – 2003   Raytheon Missile Systems, Tucson, AZ.
Systems Engineer, Telemetry Data Lab
Worked in the Integration, Test & Analysis center, supporting internal Raytheon programs. Performed tasks on a wide range of telemetry related activities, including:

- Development of a prototype software tool for the reduction, display, and presentation of telemetry data, with emphasis on handling large size datasets
- Custom software tools for specific data displays, using both IDL and MATLAB GUI toolkits
- Support for various real-time telemetry data collection activities

2000	California Institute of Technology, Pasadena, CA. *Research Assistant, Department of Physics* Part of the Infrared Astronomy group in the Caltech Physics department. Research focused on observations of radio loud galaxies at high redshifts, using high resolution spectroscopy of emission lines and broadband imaging using near IR and mid IR instruments.
1999	Carnegie Mellon University, Pittsburgh, PA. *Technical Assistant, Department of Physics* Supported commissioning of the Sloan Digital Sky Survey spectroscopic systems. Integration and testing of telescope guiding systems for spectroscopic observations. Development of software pipeline to create spectroscopic observation plates from target selection data. Analyzed commissioning data.

Field Experience

2013, 2014	On-site support for S-HIS during NASA Hurricane and Severe Storm Sentinel (HS3) field campaign. Science and technical support for S-HIS during long duration Global Hawk flights.
2011	On-site Science Technician for ICECAPS project, Summit, Greenland. Responsible for instrument monitoring and operations for a suite of remote sensing instruments sited at Summit Camp. Instrument suite included LIDAR, passive microwave radiometers, millimeter wave cloud radar, infrared radiometers, and twice daily balloon radiosonde launches.

Publications

Pettersen, C., Bennartz, R., Kulie, M. S., Merrelli, A. J., Shupe, M. D., and Turner, D. D.: Microwave signatures of ice hydrometeors from ground-based observations above Summit, Greenland. Atmos. Chem. Phys. 16, 4743-4756, doi:10.5194/acp-16-4743-2016, 2016

Merrelli, A., Bennartz, R., O'Dell, C. W., and Taylor, T. E.: Estimating bias in the OCO-2 retrieval algorithm caused by 3-D radiation scattering from unresolved boundary layer clouds. Atmos. Meas. Tech. 8, 1641-1656,

DOI:10.5194/amt-8-1641-2015, (2015).

Baum, B. A., Yang, P., Heymsfield, A. J., Bansemer, A., Merrelli, A., Schmitt, C., & Wang, C.: Ice cloud single-scattering property models with the full phase matrix at wavelengths from 0.2 to 100 μm. J. Quant. Spectrosc. Radiat. Transfer, 146, 123-139, DOI: 10.1016/j.jqsrt.2014.02.029, (2014).

Merrelli, A. & Turner, D. D.: Information content for cloud ice microphysics in the far-infrared radiance spectrum. International Radiation Symposium 2012 conference proceedings, Berlin, Germany (2012).

Turner, D. D., Merrelli, A., Vimont, D. & Mlawer, E. J.: Impact of modifying the longwave water vapor continuum absorption model on community Earth system model simulations. J. Geophys. Res., Vol. 117, D04106 (2012).

Merrelli, A. & Turner, D. D.: Comparing Information Content of Upwelling Far Infrared and Mid Infrared Radiance Spectra for Clear Atmosphere Profiling. J. Atmos. Oceanic Technol., Vol. 29, Issue 4, pp 510 - 526 (2011).

Tucker, D. L., et. al., The Sloan Digital Sky Survey monitor telescope pipeline. Astronomische Nachrichten 327, 821-843 (2006).

Castander, F. J., Nichol, R. C., Merrelli, A., and the SDSS collaboration: The First Hour of Extragalactic Data of the Sloan Digital Sky Survey Spectroscopic Comissioning: The Coma Cluster. The Astronomical Journal, Vol. 121, Issue 5, pp 2331 - 2357 (2001).

Romer, A. K., Nichol, R. C., Holden, B. P., Ulmer, M. P., Pildis, R. A., Merrelli, A. J., Adami, C., Burke, D. J., Collins, C. A., Metevier A. J., Kron, R. G. and Commons, K.: The Bright SHARC Survey: The Cluster Catalog. The Astrophysical Journal Supplement Series 126, 209 (2000).

Nichol, R. C., Romer, A. K., Holden, B. P., Ulmer, M. P., Pildis, R. A., Adami, C., Merrelli, A. J., Burke, D. J., and Collins, C. A.: The Bright SHARC Survey: The X-Ray Cluster Luminosity Function. The Astrophysical Journal Letters 521, L21 (1999).

Conference Presentations, Posters, Reports

"Combining CALIOP and OCO2 for improved XCO2 retrieval", Aronne Merrelli, R. Bennartz, and C. O'Dell. Oral Presentation at A-Train Symposium 2017, 19-21 April 2017, Pasadena, California.

"Improving XCO2 Retrievals from OCO2 by using CALIOP-derived Aerosol Priors", Aronne Merrelli, R. Bennartz, and C. O'Dell. Poster presentation A41F-0127 at 2016 Fall Meeting, AGU, San Francisco, Calif., 12-16 Dec 2016.

"The VIIRS Fast Radiative Transfer Model (VFRTM)", Aronne Merrelli; B.

Baum; P. Yang; and Y. Ding. Poster presentation at the 21st Conference on Satellite Meteorology, American Meteorological Society, Madison, WI, August 2016.

"True Ringing Artifacts in Unapodized FTS Measurements", Merrelli, Aronne; Tobin, David; Knuteson, Robert; Greenwald, Thomas; Revercomb, Hank. Poster Presentation at International TOVS Study Conference XX, Lake Geneva, Wisconsin, 28 Oct - 3 Nov 2015.

"Comparing Cross-track Infrared Sounder Observations with Forward Model Calculations", Merrelli, Aronne; Tobin, David; Knuteson, Robert; Greenwald, Thomas; Revercomb, Hank. Poster presentation IN13C-3656 at 2014 Fall Meeting, AGU, San Francisco, Calif., 15-19 Dec 2014.

"Advancing Atmospheric Chemistry Through the Use of Satellite Observations from the CrossâĂŘtrack Infrared Sounder (CrIS)" CrIS Atmospheric Chemistry Data User's Workshop Report, Sept 18-19, 2015, College Park, Maryland. DOI:10.7289/V50V89SS

"Testing the OCO-2 Retrieval Algorithm with 3D Radiative Transfer Simulations", Aronne Merrelli, R. Bennartz and C. O'Dell. Poster presentation 171 at the 14th Conference on Atmospheric Radiation, Boston, Massachusetts, July 2014.

"Radiative transfer studies in support of OCO-2: A look at clouds, shadows, and the ocean surface", R. Bennartz, A. Merrelli, C. O'Dell, T. Taylor, A. Hollstein, J. von Bismarck, J. Fischer, R. Preusker. Presentation at 2013 OCO-2 Science Team meeting, Cal Tech, March 2013.

"Impact of RHUBC-I Water Vapor Continuum Absorption Updates on Climate Simulations with CESM", A. Merrelli, D. D. Turner, D. Vimont, E. Mlawer. Poster Presentation at the third Science Team Meeting of the Atmospheric Systems Research program, Arlington, VA, March 2012.

"Comparing Clear Atmosphere Profiling with FIR and MIR Radiance Spectra", A. Merrelli, D. D. Turner, Oral Presentation at the 2011 Far Infrared Workshop, Madison, WI, November 2011.

"Comparing Information Content of Mid and Far Infrared Spectra for Clear-Sky Atmospheric Profile Retrievals" A. Merrelli, D. D. Turner. Poster Presentation at the 2010 AGU Fall Meeting, San Francisco, CA, December 2010.

"Comparing high resolution far and mid infrared spectra for clear - sky atmospheric profile retrievals", A. Merrelli, D. D. Turner. Poster Presentation at the 13th Conference on Atmospheric Radiation, American Meterological Society, Portland, OR, June 2010.

"Objective Comparison of High Resolution FIR and MIR Spectral Observations for Atmospheric Retrievals", Aronne Merrelli and David D. Turner. Poster Presentation at the first Science Team meeting of the Atmospheric Systems Re-

search program, Bethesda, MD, March 2010.

"Water Vapor Absorption in the Far Infrared", A. Merrelli and D. Turner. Poster presentation at the 6th annual NOAA CoRP Symposium, City College, New York City, August 2009.

"Defective pixel correction and restoration in staring remote sensor focal plane arrays", A. Ferro, L. Vettel, B. Everding, A. Merrelli, Ball Aerospace & Technologies Corp. Oral presentation at SPIE Great Lakes Photonics Symposium, 2006.

"Sloan Digital Sky Survey: Over One Million Spectra", with A. Pope, S. Burles, M. Newcomb, R. Nichol, R. Owen, and the SDSS collaboration. Poster presentation at the 194th meeting of the American Astronomical Society, Chicago, IL, June 1999. #04.11.

TECHNICAL SKILLS

- Highly proficient at data analysis and scientific programming with Python, MATLAB and IDL.

- Experience with radiative transfer codes SHDOM, LBLRTM, RRTM, LBLDIS, and the NCAR CESM global climate model.

- Basic knowledge of Cython, C, Fortran

- Past Experience in TCL, LabView, Code V